

# Evaluation of three insect scouting methods: Effects of overhead collection, greenhouse temperature and air jet on collection of whitefly from a *B. tabaci*-poinsettia system.

Alfredo A. Biffi, Peter Ling, Luis Canas, Ross Brazee and Richard Derksen

[Biffi.1@osu.edu](mailto:Biffi.1@osu.edu)

Department of Food, Agricultural and Biological Engineering, The Ohio State University  
OARDC, Wooster, OH 44691

## Abstract

Scouting for insect pest is the backbone of a successful Integrated Pest Management (IPM). But it is troublesome and time consuming. The goal of this research project is to develop a high resolution overhead greenhouse insect scouting device that efficiently detect and collect insect pests population. Three greenhouse insect scouting methods (yellow sticky card, mobile overhead sticky card and mobile overhead vacuum) were compared to determinate collection efficiency (CE) of adult whiteflies (*B. tabaci*) from a Poinsettia (*Euphorbia pulcherrima*) crop. The main objective was to estimate CE of two mobile overhead scouting methods and study the effects of temperature and the use of an air jet on CE of whiteflies adults. Of the three methods tested, the mobile air-assisted overhead vacuuming had the highest mean collection efficiency (MCE) and the lowest standard error (SE). Moreover, there was significant less collection efficiency for all methods, but for the mobile air-assisted vacuuming at low greenhouse temperature ( $T_1=13.5^\circ\text{C}$ ). The use of the air jet to dislodge the whiteflies from the canopy leaves significantly increased collection efficiency for all three methods. Results suggested that collection efficiency increases with insect activity and that the shear produced by the jet may help to dislodge whiteflies from the under side of the canopy leaves.

## Introduction

The benefits that insect pest scouting provide are many; early insect detection, asses to population dynamics, location of infested areas, reduce control cost by 40 to 60% (Zehnder, 1995) and pesticide applications by 30% (Cloyd, 2005). There are several studies on insect scouting methods (Parajulee, 2006) all of them evaluated collection efficiency of traditional greenhouse methods. In this research study we evaluated two greenhouse overhead automatic sampling methods against the traditional sticky card (control). Results will be used as a baseline that will help us to select the most promising greenhouse scouting method, in order to develop a high resolution automatic insect sampling device.

## Objective

Estimate collection efficiency of three insect scouting methods and study the effects of greenhouse temperature and the use of an air jet source on collection efficiency in a poinsettia-whitefly system.

## Methods

The test was conducted at the FABE/OARDC North greenhouse facility located at Wooster, Ohio. We used as plant material 192 poinsettias freedom red six inch pots donated by the entomology department. Whiteflies *B. tabaci* were obtained from the continuous rearing colonies at the Entomology Department one day before each treatment. We collected a total of 720 whiteflies (mostly pairs) each day using 120 pipettes (e.g. 6 whiteflies per pipette) for further plant inoculation. We randomly placed 5 clip cages per plant. In each clip cage we introduced 6 whiteflies which were left to settle for 18 hours. We used a complete randomized block design ( $T_1=13.5^\circ\text{C}$  and  $T_2=28.5^\circ\text{C}$ ) with two levels of air-assist: with or without. We performed 4 repetitions for each block. The experimental unit was four poinsettias Freedom Red arranged in a row configuration. Plant material average 0.25 and 0.30 m of height and canopy diameter respectively. Collection efficiency (CE) was estimated for each scouting method on each sampling date as:

$$CE = \frac{X}{N} \times 100 \quad (1)$$

Where  $X$  = number of insects the scouting method collects, and  $N$  = number of insects initially on the plot. Larger CE value indicated greater collection efficiency. Mean and standard error values for collection efficiency for all the treatments were determinate and were compared using PROC ANOVA (SAS Institute).

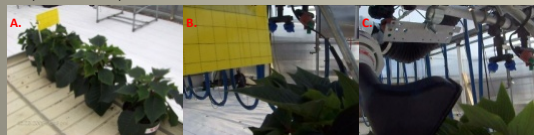


Fig. 1. Collection methods. (A) sticky card. (B) mobile overhead sticky card. (C) mobile overhead air vacuuming.

T1	T2	T3	T4	T5	T6
Control	Air Vac	Mobile sticky card	Air Vac (Air-assisted)	Control (Air-assisted)	Mobile sticky card (Air-assisted)

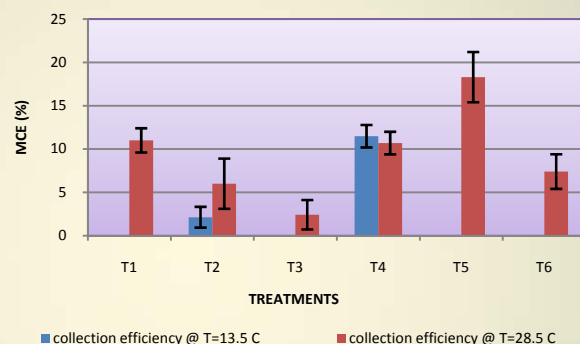


Fig. 2. Mean +/- SE of collection efficiency per method grouped air temperature.

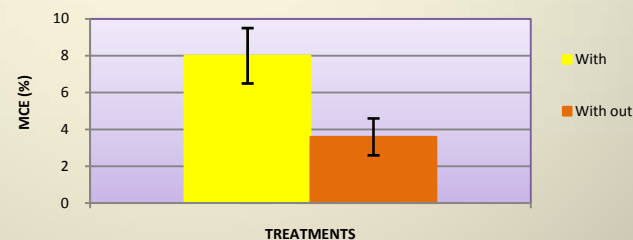


Fig. 3. Mean +/- SE of collection efficiency grouped by air assisted

## Results

- There was a significant effect ( $P < 0.05$  one sided t-test) of temperature on collection efficiency. All methods collection efficiency increased with air assisted and at  $T_2=28.5^\circ\text{C}$  (Fig. 1).
- All methods but the mobile overhead air vacuum are significantly less efficient at low greenhouse temperature  $T_1=13.5^\circ\text{C}$  (Fig. 1).
- The control (T5) was significantly more efficient at high greenhouse temperature  $T_2=28.5^\circ\text{C}$  than all other methods (Fig. 1).
- The mobile air-assisted vacuuming (T4) had the highest mean collection efficiency (MCE= 11.1 %) and the lowest standard error (SE= 0.8) (Fig. 1).
- The use of an air jet source to dislodge whiteflies from the under side of the leaf significantly increased ( $P < 0.05$ ) collection efficiency for all methods (Fig. 2).

## Conclusions

- Since insect activity increases with temperature, collection efficiency (CE) increased for all methods at high greenhouse temperature  $T_2=28.5^\circ\text{C}$ .
- We observed the control had significantly higher CE at  $T_2=28.5^\circ\text{C}$ . Implies that the high efficiency may be due to increased whitefly flight activity.
- The low standard error (SE) and the consistent collection efficiency observed at both high and low greenhouse temperatures for the air vacuum method. Suggests that this approach is the best for overhead automatic insect collection.
- The use of a jet source significantly increased CE. Suggesting that the shear force produced by the air jet at the canopy level may help to dislodge the whiteflies from the under side of the leaves.
- Further tests to determinate the shear force required to dislodge whiteflies from the under side of the leaves will be conducted to help design an automatic overhead insect vacuuming prototype.

## Discussion

Riis and Nachman (2006) observed that capture of adult whiteflies is influenced by temperature. They reported maximum capture using a pot trap (passive method) at  $27.49^\circ\text{C}$ . Our preliminary test also indicates that at high temperature ( $T_2=28.0^\circ\text{C}$ ) collection efficiency of whiteflies increases, particularly the control which is also a passive method. Lacasse et al., (1998) reported that the use of a blower-suction configuration to dislodge Colorado Potato beetles from a potato plant canopy did not have an effect on collection efficiency. Although, our experiment showed that the use of an air blower help to dislodge whiteflies more testing is needed. Due to the limited literature of CE on automatic overhead whitefly scouting, our results have established the base line we required to develop a high resolution overhead insect scouting prototype for greenhouse applications.

## Acknowledgement

We want to acknowledge the valuable help provided by Michael Klingman, Ronald Batallas, Luke Powers and Jim Hacker. This research is funded by a graduate research associate from the FABE department, The Ohio State University.

## References

- Cloyd, R., J. Faust, J. P. Konjoian, W. Uva, and K. Williams. 2005. OFA Tips on Operating a Profitable Greenhouse Business. Ohio, USA: Cuthbert and Carver
- Lacasse, B., Lague, C., Khelifi, M., and P.-M. Roy. 1998. Field Evaluation of pneumatic control of Colorado potato beetle. Canadian Agricultural engineering 40(4):273-280
- Parajulee, M. N., R. B. Shrestha, and J. F. Leser. 2006. Sampling Methods, Division Patterns, and Fixed Precision Sequential Sampling Plans for Western Flower Thrips (Thysanoptera: Thripidae) and Cotton Fleahoppers (Hemiptera: Miridae) in Cotton. Journal of Economic Entomology 99(2): 568-577
- Riis, L., and G. Nachman. 2006. Migration, trapping and local dynamics of whiteflies (Homoptera: Aleyrodidae). Agricultural and Forest Entomology 8, 233-241
- Zehnder, G. W., E. J. Sikora, and W. R. Goodman. 1995. Treatment decisions based on egg scouting for tomato fruitworm, *Helicoverpa zea* (Boddie), reduce insecticide use in tomato.